

Object Counting

DOMAIN: Cognitive Development

CLAIM: Students can use content-independent abilities and strategies as well as content-specific skills, processes, and approaches to solve problems and acquire information.

RATIONALE

Children need to develop foundational concepts, such as knowledge of numbers, in order to build future math and reading skills. The ability to understand number names, the counting sequence, and that counting tells the number of objects, are essential understandings needed in the early developmental years. Understanding counting is more than being able to count to 100. Counting is a complex concept. Children move through progressive mathematical stages in order to understand that quantities remain the same when they are rearranged; they learn to be consistent and accurate and to see relationships between numbers. Research shows that general math achievement measured around kindergarten entry has been found to be highly predictive of subsequent mathematics achievement, measured around third grade (Duncan et al., 2007; Claessens, Duncan, & Engel, 2009; Claessens & Engel, 2013). Key advocacy groups, such as the National Association for the Education of Young Children (NAEYC) and the National Council of Teachers of Mathematics (NCTM), have issued position statements on the importance of early mathematics, arguing that mathematics education for 3 to 6 year-olds is essential to promoting future mathematics achievement. (NAEYC & NCTM, 2002). Children's ability in mathematics has also been found to affect reading ability. "Most surprising is that it also predicts later reading achievement even better than early reading skills. In fact, research shows that doing more mathematics increases oral language abilities, even when measured during the following school year. These include vocabulary, inference, independence, and grammatical complexity" (Clements & Sarama, 2013).

ALIGNMENT TO NC STANDARDS

NC Foundations for Early Learning and Development

CD-10 Children show understanding of numbers and quantities during play and other activities.

NC Standard Course of Study (Common Core State Standards & Essential Standards)

K.CC.4 Understand the relationship between numbers and quantities; connect counting to cardinality.

K.CC.5 Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1-20, count out that many objects.

OBJECT COUNTING

UNDERSTANDING: Children recognize that counting tells the number of objects*.

SKILLS	A. Says or indicates counting words randomly, with one number for each object, while tapping or pointing to one and only one object to attempt to determine the number of objects in a collection.	B. Says or indicates counting words sequentially, saying one number for each object, while tapping or pointing to one and only one object to attempt to determine the number of objects in a collection without keeping track of objects counted.	C. Keeps track of objects when counting, not counting them twice or missing any.	D. States or indicates that the last number counted is the total quantity. (Cardinality)
PERFORMANCE DESCRIPTORS	<p>Liam is counting his three crayons before he begins his art project. He touches each crayon as he says the number words out loud, "one, three, six".</p>	<p>There are seven chrysalises hanging from branches placed in the butterfly pavilion. Isabella is looking at the butterfly pavilion and the teacher asks, "How many chrysalises are in the branches?" As Isabella points to some chrysalises, she says, "One, two, three, four." The teacher asks, "Did you count all of the chrysalises?" Isabella says, "Yes."</p> <p>Tameka begins exploring the acorns at the science center. She lines them up, touches each one and says, "One, two, three, four, five, six, seven, eight, nine, ten." James asks Tameka, "How many acorns are there?" Tameka touches each acorn and says, "One, two, three, four, five, six, seven, eight, nine, ten".</p> <p>Davis takes a scoop of animal crackers and places them on the napkin. He touches each animal cracker while saying one number word in order for each cracker. Not keeping track of where he started counting, Davis returns to already-counted animal crackers and recounts three of the crackers.</p>	<p>Mr. Martinez wants to make sure that each team has eight beanbags. He drops a handful of beanbags in the middle of each squad. Mr. Martinez says, "Olivia, please count the number of beanbags for your squad." Olivia moves one beanbag at a time and says "One, two, three, four, five, six, seven, eight" without counting any of them twice or missing any.</p>	<p>Mr. Martinez wants to make sure that each team has eight beanbags. He drops a handful of beanbags in the middle of each squad. Mr. Martinez says, "Olivia, please count the number of beanbags for your squad." Olivia moves one beanbag at a time and says "One, two, three, four, five, six, seven, eight" without counting any of them twice or missing any. Mr. Martinez then asks Olivia, "How many beanbags do you have for your squad?" Olivia says, "Eight."</p>

* The **amount** and **arrangement** of objects vary according to the student's needs. Therefore, it is possible that a student may demonstrate different skills based on the amounts and/or arrangements used. It is important to record these two factors with the documentation.

OBJECT COUNTING

UNDERSTANDING: Children recognize that counting tells the number of objects*.

E. States or indicates the same quantity without recounting. OR States or indicates that repeated counting yields the same number and recognizes the need to check by recounting if counting the same objects twice has yielded different answers.	F. Names or indicates the same number for rearranged objects without recounting. Explains or indicates that counting twice yields the same quantity. (Conservation)	G. Continues the counting sequence when one object is added to the set, without counting all of them again.	H. Continues the counting sequence when more than one object is added to the set, without counting all of them again.	SKILLS
<p>At the Art Center, Patrick counts out seven markers. Mrs. Sims asks Patrick, "How many markers did you count?" Without recounting the markers Patrick says, "Seven."</p> <p>At the Art Center, Patrick selects seven markers from the marker container and counts them. Mrs. Sims asks Patrick, "How many markers did you count?" Patrick says "Seven. See. One, two, three, four, five, six, seven." He touches the markers as he counts.</p> <p>At the Art Center, Patrick selects seven markers from the marker container and counts them. Mrs. Sims asks Patrick, "How many markers did you count?" Patrick says "Seven. See. One, two, three, four, five, six, seven, eight." He touches the markers as he counts, counting one of the markers twice. Recognizing that the number he counted was different than the number he told Mrs. Sims, Patrick recounts the markers, "One, two, three, four, five, six, seven. That's right, seven."</p>	<p>During snack time, Chandler takes a scoop of animal crackers, counts them, and places them on his plate. Miguel, the boy next to Chandler, asks, "How many crackers are on your plate?" Chandler answers, "Eight." Miguel then accidentally turns over Chandler's plate and the animal crackers are arranged differently on the table. Miguel says, "You have a lot of crackers. How many do you have now?" Chandler says, "Eight."</p>	<p>Brittany and Mario have jobs as cashiers in their class market. Brittany accurately counts the pennies in the cash register and tells Mario, "We have 12 pennies." Mario sees an extra penny on the floor, picks it up, hands it to Brittany and says, "Now we have 13 pennies!"</p> <p>The teacher holds up the Compliment Jar filled with cubes, one cube for every compliment the class receives. She reminds the class that yesterday they counted 8 cubes in the jar. She then holds up one more cube and asks, "If I take one more cube for the compliment we just received and put that cube in the jar, how many cubes would there be?" The children hold up their fingers indicating the amount they think are in the jar. Maria, Juanita and Chloe quickly hold up nine fingers. The teacher asks Chloe, "How many cubes do you think are in the jar?" Chloe says, "Nine, see..." Chloe holds up a cupped hand to indicate the cubes in the jar and says, "Eiiiggghhhttt". She then mimics putting another cube in her cupped hand and says, "Nine!"</p>	<p>Sarah and Zola are playing a "Plus 2" counting game. Sarah rolls the blue die and counts out eight chips and places them on the game board. Zola then rolls the red die, picks up two more chips and places them with the others on the game board and says, "10".</p>	PERFORMANCE DESCRIPTORS

* The **amount** and **arrangement** of objects vary according to the student's needs. Therefore, it is possible that a student may demonstrate different skills based on the amounts and/or arrangements used. It is important to record these two factors with the documentation.

RESOURCES USED

- Claessens, A., Duncan G., & Engel, M. (2009). Kindergarten skills and fifth-grade achievement: Evidence from the ECLS-K. *Economics of Education Review*, 28, 415-427.
- Claessens, A., & Engel, M. (2013). How important is where you start? Early mathematics knowledge and later school success. *Teachers College Record*, 115, 1-29.
- Clements, D. & Sarama, J. (2009). *Learning and teaching early math: The learning trajectories approach*. New York, NY: Routledge.
- Clements, D., & Sarama, J. (2013). *Math in the Early Years: The Progress of Education Reform*. Retrieved from <http://www.ecs.org/clearinghouse/01/09/46/10946.pdf>
- Confrey, J., Nguyen, K.H., Lee, K., Panorkou, N., Corley, A.K., & Maloney, A.P. (2012). *Turn-on common core math: Learning trajectories for the common core state standards for mathematics*. Retrieved from <http://www.turnonccmath.net>
- Copley, J., Jones, C., & Dighe, J. (2010). *The creative curriculum for preschool* (5th ed.). Bethesda, MD: Teaching Strategies, Inc.
- Daro, P., Mosher, F.A., & Corcoran, T. (2011). *Learning trajectories in mathematics*. Retrieved from http://www.cpre.org/ccii/images/stories/ccii_pdfs/learning%20trajectories%20in%20math_ccii%20report.pdf
- De Smedt, B., Verschaffel, L., Ansari, D., Grabner, R., Schneider, M., & Hannula, M. (2010). Cognitive neuroscience meets mathematics education. *Educational Research Review*, 5(1), 97-105.
- Duncan, G.J., Dowsett, C.J., Claessens, A., Magnuson, K., Huston, A.C., Klebanov, P., & Japel, C. (2007). School readiness and later achievement. *Developmental Psychology*, 43(6), 1428-1446.
- Edens, K.M., & Potter, E.F. (2012). An exploratory look at relationships among math skills, motivational factors and activity choice. *Early Childhood Education Journal*, 41, 235-243. doi:10.1007/s10643-012-0540-y
- Fuson, Karen C. & Grouws, Douglas A. (Eds.), (1992). *Handbook of research on mathematics teaching and learning: A project of the National Council of Teachers of Mathematics*. New York, NY: Macmillan Publishing Co, Inc.
- Fosnot, C.T. (2007). *Investigating number sense, addition, and subtraction*. Portsmouth, NH: Heinemann.
- Gelman, R., & Gallistel, C. (1986). *Child's understanding of number*. Boston, MA: Harvard College.
- Joyner, J., & Muri, M. (2011). *INFORMative assessment: Formative assessment to improve math achievement*. CA: Scholastic, Inc.
- K-3 North Carolina Think Tank. (2013). *Assessment for learning and development in K-3: A report by the K-3 North Carolina think tank*. Raleigh, NC: Author.
- Maclellan, E. (2012). Number sense: The underpinning understanding for early quantitative literacy. *Numeracy*, 5(2). doi: <http://dx.doi.org/10.5038/1936-4660.5.2.3>
- Myoungwhon, J., Hartman, P., Smith, T., & Wallace, S. (2013). The effectiveness of teaching number relationships in preschool. *International Journal of Instruction*, 6(1), 165-178.
- National Association for the Education of Young Children and National Council of Teachers of Mathematics. (2002). *Early childhood mathematics: Promoting good beginnings* (Position Statement). Retrieved from <http://www.naeyc.org/files/naeyc/file/positions/psmath.pdf>
- National Research Council. (2009). *Mathematics learning in early childhood: Paths toward excellence and equity*. Washington, DC: National Academies Press.
- North Carolina Department of Public Instruction. (2013). Unpacking Guides <http://www.ncpublicschools.org/acre/standards/common-core-tools/#unmath>
- North Carolina Department of Public Instruction. (2013). Quick Reference Guides <http://www.ncpublicschools.org/curriculum/links/reference-guides/>
- North Carolina Foundations Task Force. (2013). *North Carolina foundations for early learning and development*. Raleigh, NC: Author.
- Olive, J., & Caglayan, G. (2008). Learners' difficulties with quantitative units in algebraic word problems and the teacher's interpretation of those difficulties. *International Journal of Science and Mathematics Education*, 6(2), 269-292.
- Richardson, K. (2012). *How children learn number concept*. Rowley, MA: Didax, Inc.
- Sarama, J., & Clements, D. (2009). Teaching math in the primary grades: The learning trajectories approach. *Young children*, 64(2), 63-65.
- State of New South Wales Department of Education and Communities. (2013). *The numeracy continuum*. Retrieved from <http://www.numeracycontinuum.com/aspects-of-the-continuum/aspect1/8-aspect-1/27-backward-number-word-sequences>
- Thomas, G., Tagg, A., & Ward, J. (2003). *Exploring issues in mathematics education: An evaluation of the early numeracy project 2002*. Wellington, New Zealand: Ministry of Education.
- Van De Rijt, B., Godfrey, R., Van Luit, J. E., Ghesquiere, P., Torbeyns, J., Hasemann, K., & Tzuriadou, M. (2003). The development of early numeracy in Europe. *Journal of Early Childhood Research*, 1(2), 155-180. doi:10.1177/1476718X030012002
- Wiley, R., Holliday, A., & Martland, J. (2003). Achieving new heights in Cumbria: Raising standards in early numeracy through mathematics recovery. *Educational and Child Psychology*, 24(2), 108-118.
- Wright, R., Ellemor-Collins, D., & Tabor, P. (2012). *Developing number knowledge: Assessment, teaching & intervention with 7-11-year-olds*. Thousand Oaks, CA: SAGE Publications, Ltd.
- Wright, R., Staner, G., Stafford, A., & Martland, J. (2006). *Teaching number in the classroom with 4-8-year-olds*. Thousand Oaks, CA: SAGE Publications, Ltd.